(No Model.) 2 Sheets—Sheet 1.

A. G. HOLCOMBE.

ELECTRIC LAMP.

No. 255,170. Patented Mar. 21, 1882.

Fig. 1

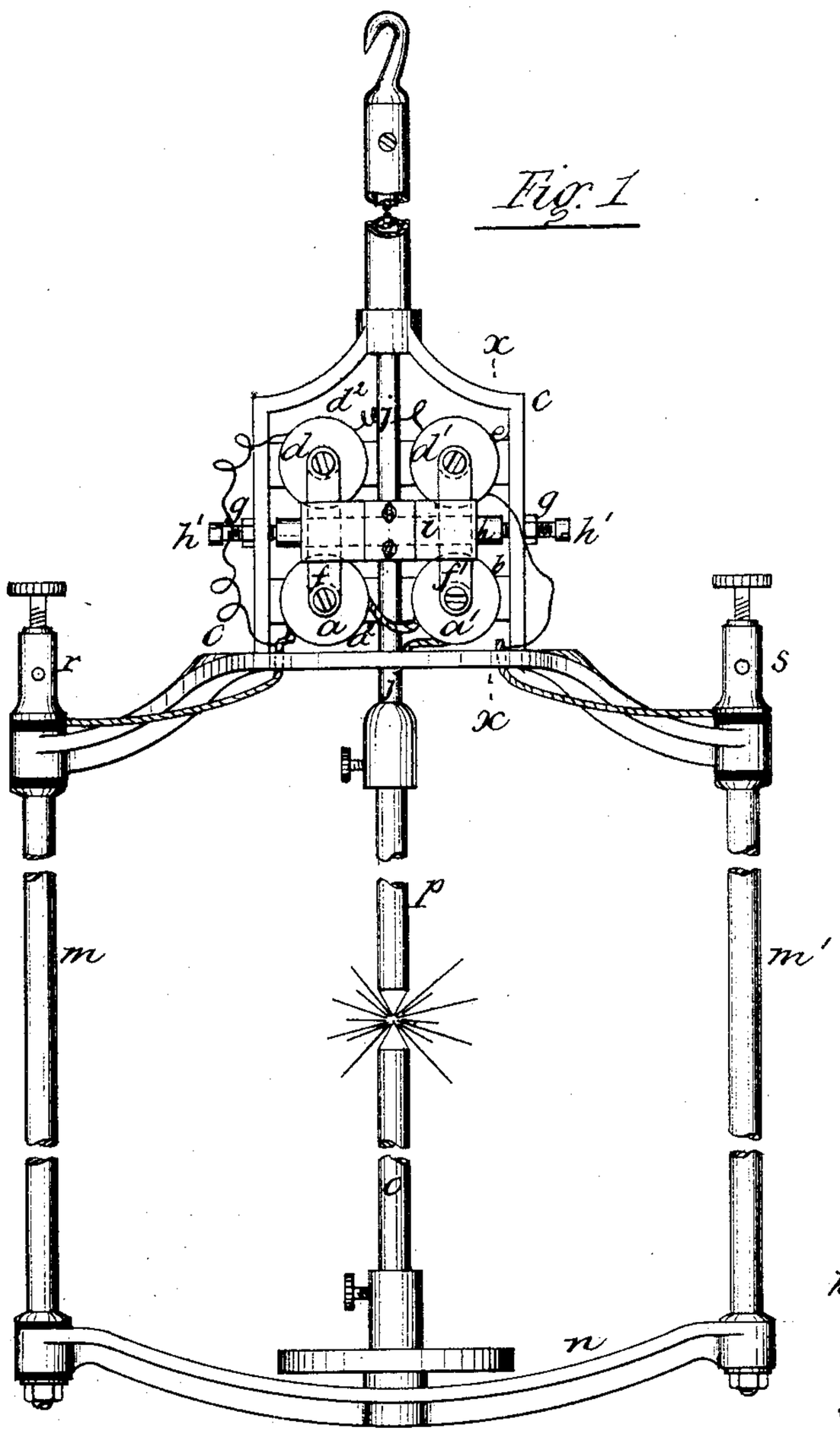


Fig. 3

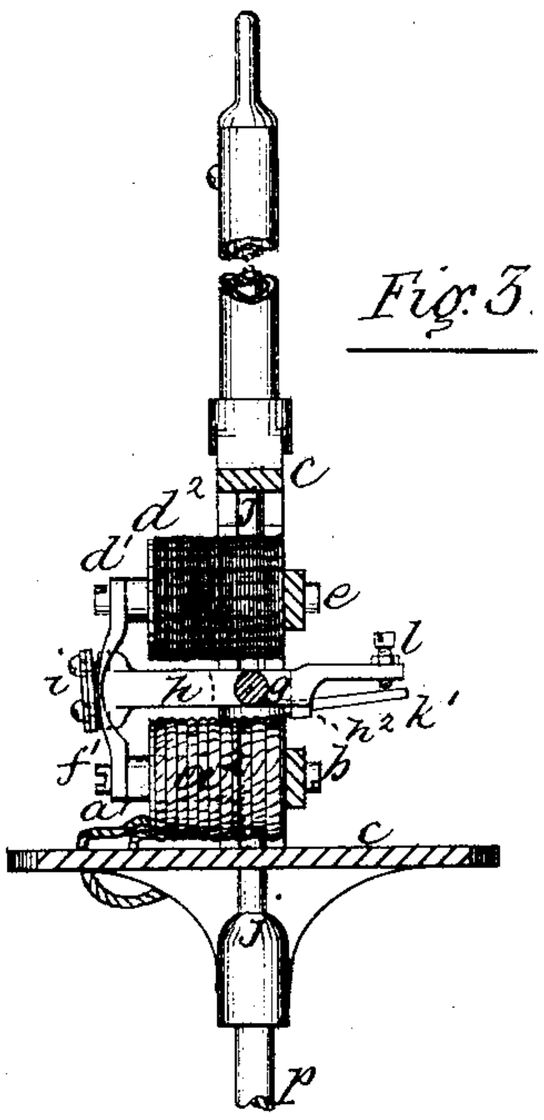


Fig. 4

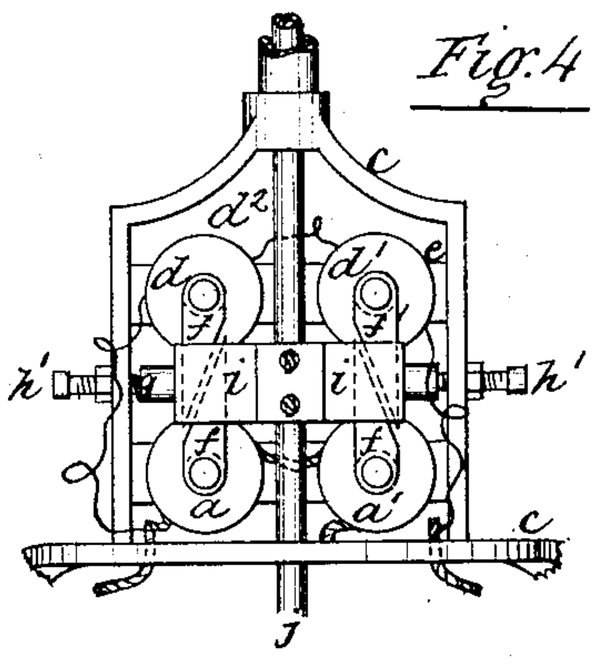
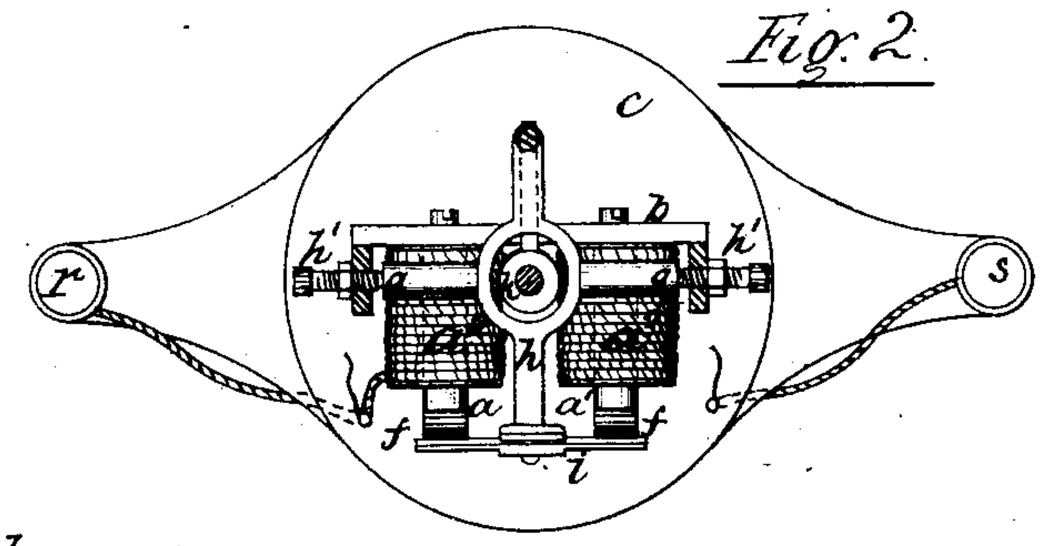


Fig. 2.



Witnesses.

H. D. Williams

E. G. Baker

Alfred G. Holcombe.

Inventor.

per Alfred Shedlock.

Atty.

(No Model.) 2 Sheets—Sheet 2.

A. G. HOLCOMBE.

ELECTRIC LAMP.

No. 255,170. Patented Mar. 21, 1882.

Fig. 5

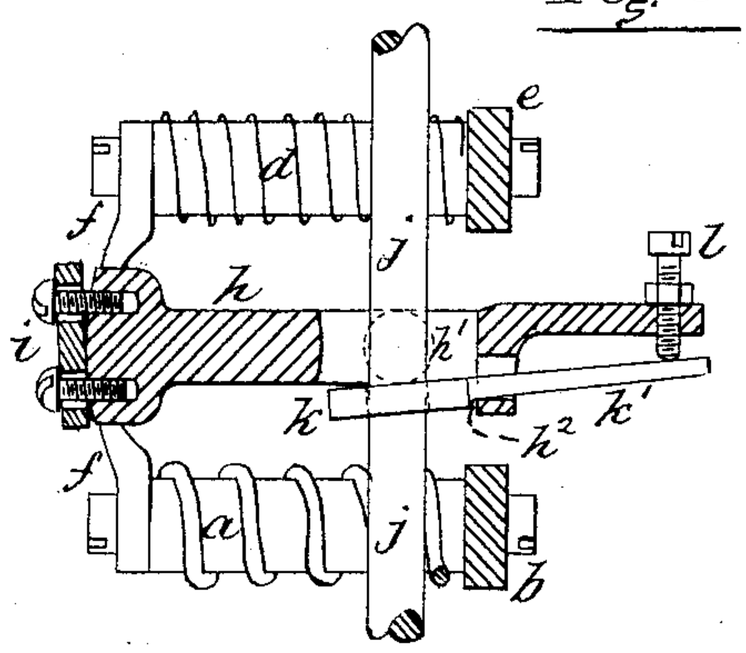
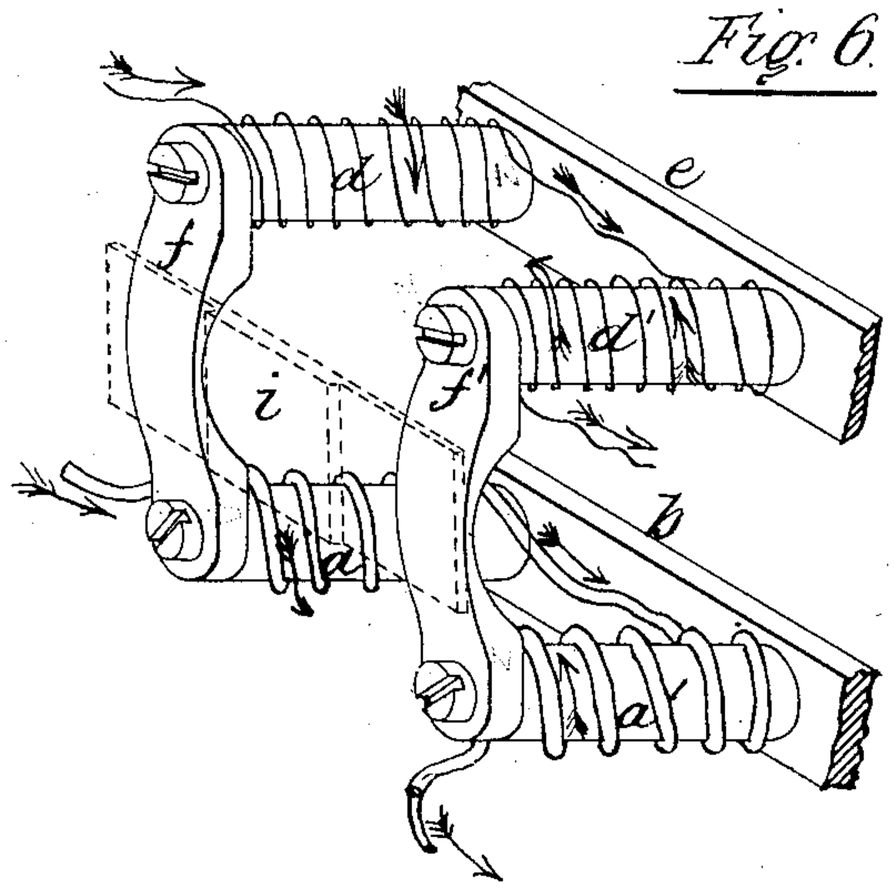


Fig. 6.



Witnesses.
H. D. Williams
E. G. Baker.

Alfred G. Holcombe,
Inventor.
per Alfred the Lock.
Atty.

UNITED STATES PATENT OFFICE.

ALFRED G. HOLCOMBE, OF NEW YORK, N. Y., ASSIGNOR TO THE STANDARD ELECTRIC LIGHT COMPANY, OF SAME PLACE.

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 255,170, dated March 21, 1882.

Application filed December 1, 1881. (No model.)

To all whom it may concern:

Be it known that I, ALFRED G. HOLCOMBE, of the city of New York, county and State of New York, have invented certain new and useful Improvements in Electric Lamps, of which the following is a specification.

This invention relates to the electro-magnetic device of electric-arc lamps, by means of which the arc is formed and the carbon-rods feed together as they are consumed.

My improved electric regulating device embraces the well-known differential principle; and it consists of a horseshoe electro-magnet having coarse-wire helices included in the arc-circuit, and a horseshoe electro-magnet having fine-wire helices included in a branch circuit, the ends of the cores of the two magnets being connected together by curved poles or bridge-pieces, so that the cores of the two magnets form a continuous magnetic circuit.

The armature consists of a bar of iron arranged in front of the two curved poles or bridge-pieces and carried by a lever whose pivotal center is the center of the curves of the pole or bridge pieces, the axis of the same being on the dividing-line of the two magnets, so that the armature is attracted toward the coarse-wire magnet when the arc decreases in resistance, and so raises the upper carbon by means of a clamping device connecting the armature-lever to the upper-carbon rod, and is attracted toward the fine-wire magnet when the arc increases in resistance. The current flows through the magnets in such direction as to cause the two curved poles or bridge-pieces to be of opposite polarity, and as the current increases in one magnet it decreases in the other, and so causes the consequent magnetic points to move along the poles, consequently drawing the armature with them, as it is in such close proximity to the poles or bridge-piece as to act as a keeper for the magnetism induced in them. By this arrangement the electric current has such perfect control over the carbon-rod clamping and feeding device that a given arc may be maintained without any perceptible fluctuation until the carbons are completely consumed, and the necessity of using springs and dash-pots to regulate and govern the working strength of the magnets obviated in all ordinary circumstances.

To describe my invention more particularly and a method by which the same may be practically carried out, I will now refer to the accompanying drawings, forming part of this specification, in which—

Figure 1, Sheet 1, is a front elevation of an electric lamp embodying my improvements. Fig. 2, Sheet 1, is a plan view of the same with the upper frame broken away. Fig. 3, Sheet 1, is a sectional side elevation cut through the line *x x*, Fig. 1; and Fig. 4, Sheet 1, is a similar view to the upper part of Fig. 1, showing a modification in the pole or bridge pieces. Fig. 5, Sheet 2, is an enlarged sectional view of the electro-magnetic system, and Fig. 6, Sheet 2, is a perspective view of the same.

As shown in the drawings, the two magnets are longitudinally arranged, the fine-wire one being above the coarse-wire one. They and the armature may be arranged in any desired position, according to the construction of the clamping and feeding device with which they are combined.

The central cores, *a* and *a'*, of the coarse-wire magnet a^2 are connected to the bar *b*, forming a part of the upper frame, *c*, of the lamp, and the cores *d* and *d'* of the fine-wire magnet d^2 are connected directly over the cores of the magnet a^2 to the bar *e*, also forming a part of the frame *c*, when said frame *c* is made of iron; but when the frame is of brass or other non-magnetic material, then these bars *b* and *e*, which should be made of iron, would be connected to it. The external ends of the cores *a* and *a'* of the magnet a^2 and the external ends of the cores *d* and *d'* of the magnet d^2 are respectively joined together by the two pole or bridge pieces *f* and *f'*, so that the cores of the two magnets a^2 and d^2, with the pole-pieces *f* and *f'* and the bars *b* and *e*, form one continuous iron connection in which magnetism is induced by the currents flowing through the helices of the magnets a^2 and d^2. The pole-pieces *f* and *f'* are curved, the center of the same being at *g*, on which center the lever *h*,

located between the magnets a^2 and d^2, rocks, supported by the pointed bearings h' h' in the frame c. The front end of the lever h, projecting between the pole-pieces f and f', is rounded, and, by means of screws, to this rounded surface is secured the armature i, the ends of which lie over the curved pole-pieces f and f'. The upper-carbon rod, j, passes down between the two helices of the magnets a^2 and d^2 and through an opening in the lever h, and over this carbon-rod j is the ring-clamp k, having a tail-piece, k', which rests on a supporting-edge, h^2, on the lever h, and said lever has an arm projecting over the tail-piece k' of the clamp, through which passes the adjustable set-screw l, set so as to come in contact with the tail-piece k' to free the clamp from the rod j, when the armature is moved up over the pole-piece f and f' as near to the cores of the fine-wire magnet d^2 as is desirable. This clamping device k k' l h^2 is described and claimed in an application for Letters Patent filed by Levi H. Colborne and myself, bearing even date with this application; so I do not here claim anything relating thereto.

The other parts of the lamp are of the ordinary construction, m m' being the side bars, n the lower cross-bar supporting the lower carbon, o, and p the upper carbon, secured to the end of the rod j, and r and s binding-posts. The current passes in at the post r to coarse-wire magnet a^2, and from it to the frame c, down the rod j, carbon p, carbon o, up the side frame, m', and out by the post s. The current also branches and passes around the magnet a^2, and through the magnet d^2, out by the post s. The current passes around the cores a and a' of the coarse-wire magnet a^2 and the cores d and d' of the fine-wire magnet d^2, as indicated by the arrows in Fig. 6, making a south pole of the pole-piece f, which connects the cores a and d, and a north pole of the pole-piece f', which connects the cores a' and d'. The armature i (shown by dotted lines in this view) follows the consequent points which move along the pole-pieces f and f' as the relative quantities of current traversing around the cores a and a' of the coarse-wire magnet and around the cores d and d' of the fine wire magnet vary.

Assume the carbon-rods to be in contact and the armature in its highest position. This is the position the armature takes when no current is passing, as the weight of the carbon-rod j is opposed to it; but to insure this position of the armature the other side of the lever h may be weighted or a spring attached thereto to balance the armature. Now, the first action of the current in passing through the lamp is to draw the armature i to the consequent points of the pole-pieces f and f' when the arc is normal, which will be somewhere near to their centers, and so raise the carbon p to form the arc between its ends and the carbon o. Upon the arc increasing in length a greater proportion of the current passes through the fine-wire magnet d^2, and so causes the consequent points of the poles f and f' to travel upward, due to the increase of inductive action on the armature i from the magnet d^2 and a decrease of inductive action on it from the magnet a^2. The armature follows such consequent points, and so lowers the carbon p until the adjustable screw l comes in contact with the tail-piece k' of the clamp, thereby allowing the rod j to slide through the clamp, reducing the resistance of the arc when the armature is moved slightly toward the coarse-wire magnets a^2, and the tail-piece k' relieved from the screw l, and the arc kept at its normal length. The armature is so sensitive to the slightest variations in the current, as the consequent points of the poles respond so quickly to the variations of the magnetic intensities of the two magnets that the clamping device is kept all the time just on the point of releasing the rod j.

As before stated, the face of the arm of the lever h, to which the armature i is secured by screws, is curved. The screws are above and below the center line of this curved face, so that by adjusting them the face of the armature adjacent to the curved poles f and f' may be set at different angular positions thereto, thus providing a means for regulating the movement of the lever h by varying the magnetic inductive action of the electro-magnets on the armatures.

The electro-magnet shown at Fig. 4 is similar to those shown in the other views of the drawings, with the exception of the curved poles f and f' being split diagonally in such a manner that both parts of each pole are always under the armature i.

It is obvious that the curvature of the poles f and f' may be generated from a center either within or beyond the center g, if it is desired that the rocking armature i should vary in its distance from the poles f and f' as it moves, or that the poles may be made straight and the armature adapted to move in front of them, parallel thereto, without departing from the nature of my invention or the principle involved therein; so I do not wish to confine myself to the particular construction shown.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A differential electro-magnetic system composed of a horseshoe-magnet having coarse-wire helices and a horseshoe-magnet having fine-wire helices, the cores of the two magnets being joined together by pole-pieces, in combination with an armature adapted to move in front of the pole-pieces from one magnet to the other, substantially as set forth.

2. In combination, the differential electro-magnetic system a, a', a^2, b, d, d', d^2, e, f, and f', lever h, armature i, carbon-rod j, and a clamping device, substantially as described, connecting the lever h and carbon-rod j, as and for the purpose set forth.

3. The coarse-wire electro-magnets a b, the fine-wire electro-magnets d d e, and connecting pole-pieces f and f', in combination with the

armature *i* and rocking lever *h*, substantially as set forth.

4. The rocking lever *h*, having a rounded surface at its end, in combination with the armature *i*, connected to said rounded surface by means of screws, substantially as and for the purpose set forth.

In witness whereof I have hereunto set my hand, at New York, county and State of New York, this 29th day of November, A. D. 1881.

ALFRED G. HOLCOMBE.

In presence of—

ALFRED SHEDLOCK,

THOS. HAMPSHIRE.